

A method of forming a pattern of cells on a surface, cellular networks and tissues based thereon

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1. A method of forming a pattern of cells on a surface, said surface being prepatterned in having a pattern of cell-growth promoting molecules and/or cell-growth inhibiting molecules attached thereon, characterised in that cells are cultured on said prepatterned surface such that they form a pattern of cells on said surface, said cells being whole tissue.
2. A method according to claim 1 characterised in that said whole tissue is derived from an organism's body.
3. A method according to any of claims 1 – 2 characterised in that said whole tissue is derived from an organ selected from the group comprising brain, liver, kidney, muscle, skin, bone, lung and heart.
4. A method according to any of the preceding claims characterised in that said cells are organ slices.
5. A method according to claim 4 characterised in that said cells are brain slices.
6. A method according to any of the preceding claims characterised in that said pattern of cell-growth promoting molecules and/or cell-growth inhibiting molecules attached on said pre-patterned surface allows for the guided growth and migration of cells.
7. A method according to claim 6 characterised in that said pattern of cell-growth promoting molecules and/or cell-growth inhibiting molecules mimics the arrangement of cells in an organ.

8. A method according to any of claims 1 – 7 characterised in that said pattern of cell-growth promoting molecules and/or cell-growth inhibiting molecules has a structure with lines and nodes.

9. A method according to claim 8 characterised in that said lines have a width in the range from 1 – 8 micrometers and said nodes have a diameter in the range from 1 – 30 micrometers.

10. A method according to claim 9 characterised in that said lines have a width in the range from 1 – 6 micrometers and said nodes have a diameter in the range from 8 – 16 micrometers.

11. A method according to claim 10 characterised in that said lines have a width in the range from 2 - 4 micrometers and said nodes have a diameter in the range from 10 – 14 micrometers.

12. A method according to any of the preceding claims characterised in that said pattern of cell-growth promoting molecules and/or cell-growth inhibiting molecules is formed by at least one layer of a substance selected from the group comprising polypeptide, polyethyleneimine and polystyrene.

13. A method according to claim 12 characterised in that said polypeptide is selected from the group comprising extracellular matrix proteins, poly-L-lysine and poly-ornithine.

14. A method according to claim 13 characterised in that said extracellular matrix proteins are selected from the group comprising laminin and fibronectin.

15. A method of forming a pattern of cells on a surface, said surface being prepatterned in having a pattern of cell-growth promoting molecules and/or cell-growth inhibiting molecules attached thereon, in particular according to any of the preceding claims, characterised in that cells are cultured on said prepatterned surface such that they form a pattern of cells on said surface, said cells being selected from the group comprising whole tissue and dissociated cells, further characterised in that said pattern of cells, after having been formed on said prepatterned surface, is transferred to a second surface in a transfer step.

16. A method according to claim 15 characterised in that said transfer step comprises the sequence:

- a) embedding said pattern of cells in a matrix,
- b) lifting said matrix including said pattern of cells from said prepatterned surface,
- c) contacting said pattern of cells embedded in said matrix with said second surface.

17. A method according to any of claims 15-16 characterised in that said transfer step further comprises the sequence:

- d) releasing said pattern of cells from said matrix,
- e) removing said matrix from said pattern of cells.

18. A method according to any of claims 16-17 characterised in that said matrix is a cell-compatible matrix.

19. A method according to any of claims 16-18 characterised in that said matrix is a matrix composed of a material selected from the group comprising agarose, fibrin, collagen and cellulose.

20. A method according to any of claims 16 – 18 characterised in that said matrix is a matrix composed of a curable material.

21. A method according to claim 20 characterised in that said curable material is selected from the group comprising agarose.

22. A method according to any of claims 16-18 characterised in that said matrix is a matrix composed of a material capable of forming a gel.

23. A method according to claim 22 characterised in that said material capable of forming a gel is selected from the group comprising fibrinogen and collagen.

24. A method according to any of claims 15 – 21 characterised in that said second surface is selected from the group comprising surfaces of bioelectrical devices, sensors, electrical components, tissues, implants and transplants.

25. A method according to any of claims 16 – 24 characterised in that said embedding is achieved by

- aa) partially or fully covering said pattern of cells with said matrix in a liquid form, and
- ab) forming said matrix.

26. A method according to claim 25 characterised in that forming said matrix (ab)) is achieved by increasing the temperature above the gel-transition temperature and/or addition of at least one gel-inducing component.

27. A method according to claim 26 characterised in that said gel-inducing component is selected from the group comprising thrombin and other blood-coagulation factors.

28. A method according to any of claims 17 – 27 characterised in that said releasing said pattern from said matrix is achieved by enzymatic degradation and/or lowering the temperature below the gel-transition temperature.

29. A pattern of cells producible by a method according to any of claims 1 – 14.

30. A pattern of cells on a surface producible by a method according to any of claims 1 – 14.

31. A pattern of cells producible by a method according to any of claims 1 - 28.

32. A pattern of cells on a surface producible by a method according to any of claims 1 - 28.

33. An artificial tissue producible by a method according to any of claims 1-14.

34. An artificial tissue on a surface producible by a method according to any of claims 1-14.

35. An artificial tissue producible by a method according to any of claims 1-28.

36. An artificial tissue on a surface producible by a method according to any of claims 1-28.

37. A combination of patterns of cells according to any of claims 29-32.

38. A combination of artificial tissues according to any of claims 33-36.

39. A combination of patterns of cells according to any of claims 29-32 and artificial tissues according to any of claims 33-36.

40. Use of a pattern of cells according to any of claims 29 – 32 and/or an artificial tissue according to any of claims 33-36 and/or a combination according to any of claims 37-38 in a device selected from the group comprising sensors, technical substrates, tissues, implants and transplants.